

PATENT APPLICATION

Docket No.: N.C. 83,661

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: HSU et al.
Application No.: not yet assigned (div. of
appln. no. 09/531,159)
Filed: on even date herewith
For: METHOD FOR PREPARING
EFFICIENT LOW VOLTAGE PHOSPHORS

Examiner: not yet assigned
Group Art Unit: not yet assigned

March 6, 2002

Assistant Commissioner of Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to an examination on the merits, please amend the above-identified application as follows:

IN THE SPECIFICATION:

1. Please delete "AND PRODUCTS PRODUCED THEREBY" from the title. In other words, the title should read "METHOD FOR PREPARING EFFICIENT LOW VOLTAGE PHOSPHORS".

2. Page 1, after the title of the invention, please insert the following new paragraph:

This is a divisional application of copending United States patent application 09/531,159, inventors Hsu et al., filed March 17, 2000, the entirety of which is herein incorporated by reference.

3. On page 10, please amend the paragraph beginning on line 14 to read:

After the solution containing at least the alkoxide precursor and the dopant precursor is provided, a solid particle precursor is then added. Typically, the solid particle precursor is nanoparticulate, although particles in the micron range may be used. The particles have a greatest dimension of about 10,000 nm or less, and should be as small in size as possible, preferably less than 10 nm. Typically, these nanoparticles may be silica, metal oxide, metal sulfide, metal oxysulfide, metal halide, metal carbonate, metal phosphate, metal sulfate, semiconductor-oxide (e.g., germanium oxide), pure metal or mixtures thereof. Specifically, silica such as fumed silica, V_2O_5 , Y_2S_3 , $GdOS_2$, ZnO , GdS_3 , La_2O_3 , Al_2O_3 , CdS , and the like may be used. With respect to silica, AEROSIL[®] fumed silica from Degussa Corporation can be used. The amount of solid particle precursor usually is close to the stoichiometric amount determined by the phosphor compound, although the proportions for optimal light output are to be adjusted (or fine-tuned) empirically. Obviously, if the proportions are too far off, the desired phosphor compound and crystal structure cannot be formed properly.

4. Please amend the paragraph on page 5, beginning at line 7 to read:

It is also an object of the present invention to provide a method for preparing phosphors (e.g., orthosilicate phosphors) particularly adapted for use in low voltage operation (e.g., less than 5 kV) in applications such as flat panel displays, field emitter displays (FEDs), plasma displays, phosphor components for electroluminescent displays (ELDs), screens for TVs, field

emission and plasma displays that do not have conventional screens (i.e., luminescent components built into or on the substrate), x-ray imaging displays (in lieu of photographic plates), a phosphor screen, or a detector for x-ray or charged particles, and the like.

IN THE CLAIMS:

Please cancel claims 1 through 17.

Please add the following new claims.

18. (New) A method of preparing a multilayer phosphor product on a substrate comprising the steps of:

- (a) providing a solution comprising an alkoxide precursor and a dopant precursor;
- (b) mixing said solution with a solid particle precursor;
- (c) inducing a sol-gel condensation reaction to form a sol-gel condensation reaction mixture;
- (d) spreading the sol-gel condensation reaction mixture on a substrate;
- (e) drying the sol-gel condensation reaction mixture;
- (f) repeating steps (a) through (e) as needed to produce a desired thickness of film;
and
- (g) heating the thick film.

19. (New) The method according to claim 18, wherein said solution further comprises a hydrolysis agent.

20. (New) The method according to claim 18, wherein a hydrolysis agent is added after said step (b).

21. (New) The method according to claim 20, wherein said hydrolysis agent is added immediately before step (c).

22. (New) The method according to claim 18, wherein said solution further comprises a reagent capable of inhibiting condensation reactions before step (b) in said solution.

23. (New) The method according to claim 19, wherein said hydrolysis agent is selected from the group consisting of water, tetramethylammonium hydroxide, and mixtures thereof.

24. (New) The method according to claim 20, wherein said hydrolysis agent is selected from the group consisting of water, tetramethylammonium hydroxide, and mixtures thereof.

25. (New) The method according to claim 18, wherein said dopant precursor is an alkoxide, an acetate, an organometallic compound, an inorganic salt, or mixtures thereof.

26. (New) The method according to claim 18, wherein said solid particle precursor is silica, metal oxide, metal sulfide, metal oxysulfide, metal halide, metal carbonate, metal phosphate, metal sulfate, GeO_2 , pure metal or mixtures thereof.

27. (New) The method according to claim 26, wherein said solid particle precursor is fumed silica.

28. (New) A method of preparing a multilayer phosphor product on a substrate comprising the steps of:

- (h) providing a solution comprising an alkoxide precursor and a dopant precursor;
- (i) mixing said solution with a solid particle precursor, wherein said solid particle precursor have an average particle size of from about 2 to about 10,000 nm;
- (j) inducing a sol-gel condensation reaction to form a sol-gel condensation reaction mixture;
- (k) spreading the sol-gel condensation reaction mixture on a substrate;
- (l) drying the sol-gel condensation reaction mixture;
- (m) repeating steps (a) through (e) as needed to produce a desired thickness of film;
and
- (n) heating the thick film.

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Remarks

Claims 18 through 28 presently appear in this case. Claims 1 through 17 have been deleted from the previous application as drawn to a non-elected invention. A request to add claims 18 through 28 is included in this preliminary amendment.

The changes to the Specification were to amend the title, reference the parent application, and make changes that had occurred during the prosecution of the parent application. One change that had occurred during the prosecution of the parent was to correct a typographical error. The solid particle precursor has a particle size range from 2 to 10,000 nm, not 2 to 100 nm. The support for this range is found in Claim 6 as originally filed. Another change that had occurred during the prosecution of the parent was to include a phosphor screen, or a detector for x-ray or charged particles. This amendment is supported by Claims 13, 15 and 17 as originally filed.

A favorable action at the Examiner's earliest convenience is earnestly solicited.

No issue of new matter or lack of adequate written description should arise as a result of the entry of the above amendment.

Attached hereto is a marked-up version of the changes made to the specification by the current amendment. The attached page is captioned "Version with markings to show changes made."

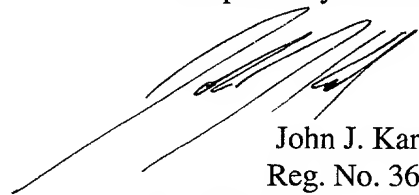
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Kindly charge any additional fees due, or credit overpayment of fees, to Deposit Account
No. 50-0281.

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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Version with markings to show changes made

In the Specification:

Please amend the Title as follows:

METHOD FOR PREPARING EFFICIENT LOW VOLTAGE PHOSPHORS-AND
PRODUCTS PRODUCED THEREBY

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